Remarks

In view of the foregoing amendments and the following remarks, Applicants request reconsideration of the present application. Claims 37 and 38 have been amended to correct their dependency.

The Examiner has rejected Claims 12-15, 17-20, 25-29, 37 and 38 under 35 USC §103(a) as being unpatentable over U.S. Patent No. 5,644,193 by Matsuda et al. in combination with U.S. Patent No. 5,932,139 by Oshima et al. The Examiner states that Matsuda et al. teaches a phosphor coating for cathode ray tubes, fluorescent lamps and radiation screens. The Examiner states that the phosphor coating suspension includes spherical particles having an average particle size of from 0.5 to 20 μm and that the spherical particles can be oxides or sulfides of phosphor and that the coating can be applied by syringe injection.

The Examiner states that Matsuda et al. fails to teach that the phosphor particles are hollow or that the coating can be applied by an ink-jet in an x-y fashion, but that Oshima et al. teaches hollow phosphor particles applied by ink-jet printing. Therefore, it would have been obvious to have modified the Matsuda et al. process by forming the phosphor coating with hollow particles and applying the coating by ink-jet as evidenced by Oshima et al. because of the expectation of similar results.

"To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference . . . Second, there must be a reasonable expectation of success. Finally, the prior art reference . . . must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." MPEP § 2143.

It is respectfully submitted that the Examiner has not provided the requisite motivation to modify Matsuda et al. based on the disclosure of Oshima et al. to arrive at Applicant's invention. Matsuda et al. is directed to phosphor compositions for cathode-ray tubes (i.e., an output phosphor screen), fluorescent lamps and radiation intensifying screens. The particles are spherical and have an average particle size of 0.5 to 20 μm. In

each of the applications disclosed by Matsuda et al., the phosphor particles are deposited in a uniform (i.e., non-patterned) layer on the device. For the cathode ray tube, the particles are deposited uniformly over a screen (See Fig. 2 of Matsuda et al.). For a fluorescent lamp, the particles are deposited uniformly on an interior surface of a glass tube (see Fig. 3 of Matsuda et al.) and for radiation intensifying screens, the particles are deposited in a uniform layer over the screen surface (see Fig. 5 of Matsuda et al.).

Oshima et al. is directed to the deposition of fluorescent substances for marking purposes, similar to a bar code. The fluorescent substances can be deposited using an ink-jet device. The fluorescent substances can include fluorescent particles whose average particle size is related to the infrared radiation used to stimulate the particles, and the average particle size is less than about 0.65 μm (Col. 30, lines 24-42). The particles are also non-spherical (See Fig. 25).

The Examiner states that it would have been obvious to deposit the coating of Matsuda et al. using an ink-jet printer as evidenced by Oshima et al. However, an ink-jet printer or other direct-write tool that is controllable over an x-y grid (e.g., to form patterns) would not be a suitable or desirable deposition method for the devices disclosed by Matsuda et al. For example, the syringe-deposition method disclosed by Matsuda et al. is used to coat the *interior* of a "small-diameter" lamp. A direct-write deposition method, controllable over an x-y grid, would not be useful for coating the interior a fluorescent lamp.

Further, neither Matsuda et al. or Oshima et al. recognize the advantages of using spherical phosphor particles for direct-write deposition methods such as ink-jet devices. Such advantages are discussed at pages 13-14 of the present application. Spherical particles are advantageous because they are able to disperse more readily in a liquid suspension and impart advantageous flow characteristics to the suspension, particularly for deposition using a direct-write tool. For a given level of solids-loading, a liquid suspension of spherical particles will have a lower viscosity than a composition having non-spherical particles. Spherical particles are also less abrasive than jagged particles, reducing the amount of abrasion and wear on the direct-write tool.

While Matsuda et al. disclose spherical phosphor particles for particular applications that do not utilize a direct-write tool, there is no recognition of the advantages of the use of spherical particles having a specific size range in a direct-write deposition tool. Oshima et

al. disclose particles that are fabricated by solid-state calcining and are jagged and irregular in shape and do not recognize the advantages of spherical particles.

Independent Claim 12 recites a method for depositing a phosphor pattern on an article using a direct-write tool by providing a suspension of phosphor particles that are substantially spherical and have an average particle size of from about 0.1 to 20 μm and depositing the suspension using a direct write tool that is controllable over an x-y grid. The cited references do not disclose or suggest this novel combination, nor the advantages realized thereby.

Claim 17 recites that the apparent density of the phosphor particles is not greater than about 20 percent of the theoretical density of the phosphor compound. There is nothing in Matsuda et al. that suggests the particles have a density that is substantially less than the theoretical density and the manufacturing method disclosed by Matsuda et al. (fusing particles in a plasma) would likely lead to highly dense particles. Further, nothing in Oshima et al. discloses or suggests particles having a low density. Oshima et al. merely suggest selecting the density of the *binder* to satisfy a particular relationship with the density of the particles (Col. 33, lines 4-11).

Claim 29 recites the deposition of the particles in predetermined pixel regions. Neither Matsuda et al. nor Oshima et al. disclose the deposition of phosphor particles in pixel regions, particularly using a direct-write tool.

In view of the foregoing, Applicants request reconsideration and removal of this rejection with respect to Claims 12-15, 17-20, 25-29, 37 and 38.

The Examiner has also rejected Claims 16, 24 and 30-36 under 35 USC §103(a) as being unpatentable over U.S. Patent No. 5,644,193 by Matsuda et al. in combination with U.S. Patent No. 5,932,139 by Oshima et al. further in view of U.S. Patent No. 5,662,831 by Chadha. The Examiner states that Matsuda et al. in combination with Oshima et al. fail to teach the coating being formed on a flat panel display. However, Chadha teaches luminescent phosphor coating on articles such as field emission displays and plasma displays and articles related thereto.

Claim 16 recites that the article is a panel for a flat panel display. Neither Matsuda et al. nor Oshima et al. disclose or suggest such a method for fabricating a flat panel display or any similar article. While Chadha discloses flat panel displays, Chadha does not

recognize the advantages afforded by depositing phosphor powders onto a flat panel display using a direct-write tool. Among these advantages are that higher resolution displays can be obtained since direct-write devices produce higher resolution than traditional screen printing or slurry techniques. Further, the amount of phosphor powder that is used when constructing a display is reduced since the amount of phosphor powder that is wasted is reduced. The direct-write manufacturing process is faster and can be easily automated using CAD/CAM techniques. For high resolution displays, the direct-write deposition method offers better registering, that is, it places the subpixels in the correct location with respect to the other subpixels.

Independent Claim 24 recites a method for making a flat panel display using a direct-write tool that is controllable over an x-y grid by depositing phosphor particles in predetermined pixel regions. As is discussed above, none of the cited patents disclose or suggest such a method for making a flat panel display or similar article, absent the teaching of the present invention. Claims 30-36 depend upon Claim 24 and include all of the limitations thereof. For example, Claim 33 recites a step of depositing second phosphor particles on the display screen in pre-determined pixel regions. Neither Matsuda et al. nor Oshima et al. nor Chadha disclose the deposition of two different phosphors in pixel regions using a direct-write tool.

In view of the foregoing, removal of this rejection of Claims 16, 24 and 30-36 is respectfully requested.

A fee for the extension of time also accompanies this response. Please credit any overpayment or charge any underpayment to Deposit Account No. 50-1419. A Notice of Appeal and the appropriate fee also accompanies this response. It is not believed that any additional fees are owed with respect to this response, however any such fees can also be charged to Deposit Account No. 50-1419.

Applicants believe that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution and/or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

MARSH FISCHMANN & BREYFOGLE LLP

By: ____________________

David F. Dockery
Registration No. 34,323
Marsh Fischmann & Breyfogle LLP
3151 South Vaughn Way, Suite 411
Aurora, Colorado 80014
Telephone: (303) 338-0997
Facsimile: (303) 338-1514

Date: October 31, 2003